Presentation at bit.ly/1p9Q7Re

Lessons Learned from Doing Number Talks

MaTHink 2016

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RUSD staff development specialists

Big Lessons Learned

1. Prepare by doing the math, understanding strategies, and representing student thinking
2. Great formative assessment tool
3. Students may need support for grade-level work - representational tools can help
4. Making connections with other math instruction

Key Understandings

- Number Talks as **formative assessments** of student thinking
- Leverage the **symbiotic relationship** between Number Talks and fluencies, computation, representations, and student engagement in the Mathematical Practices.
- **Explicitly connect** Number Talks to other important mathematics instruction

Arithmetic algorithms are remarkable tools; they are reliable and efficient... The trouble is that their very compactness ‘hides the meaning and complexity of the steps involved.’

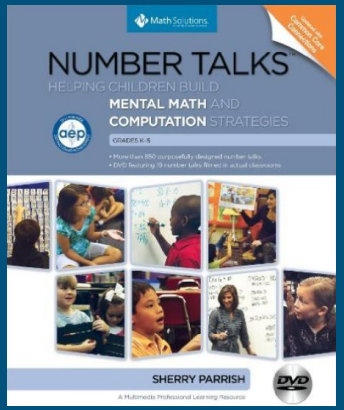
Hyman Bass in Humphreys & Parker (2015)

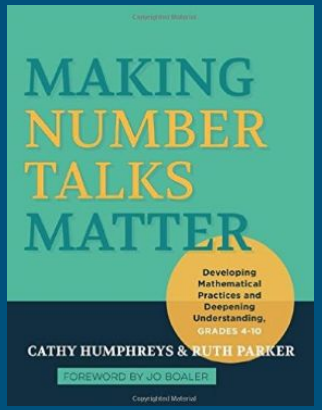
1. Preparation

Strategies, Properties, & Base-10

Representing student thinking

Using Representational Tools





Mathematics Framework

for California Public Schools:
Kindergarten Through Grade Twelve

Planning Sheets

Single Problem or String?

Language - Vocabulary

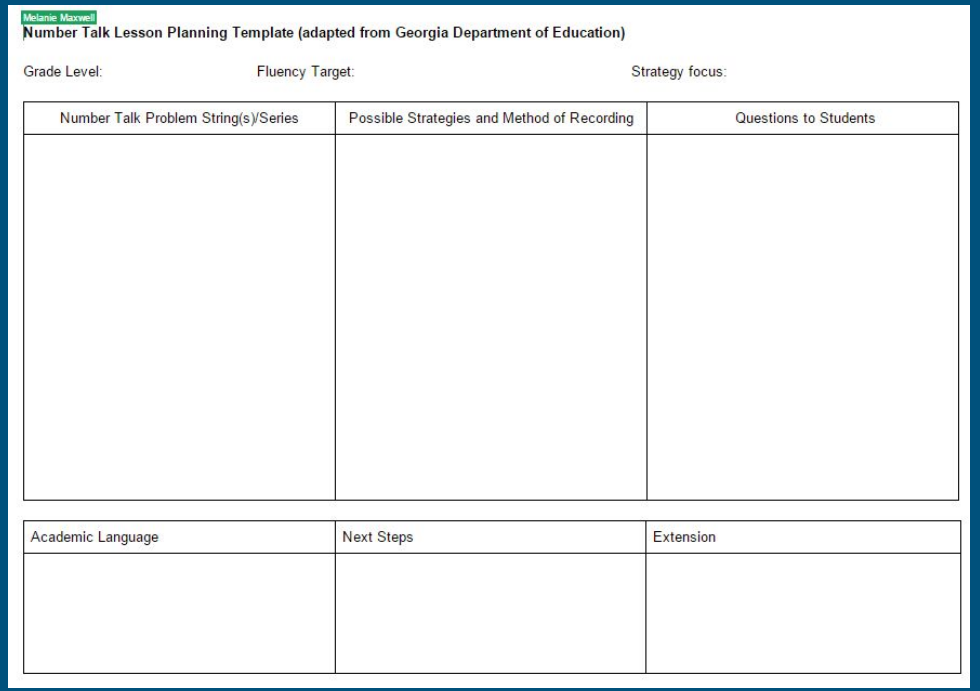
Strategies

Student Thinking

Mathematical Representations

Questions

Extensions & Next Steps



Melanie Maxwell

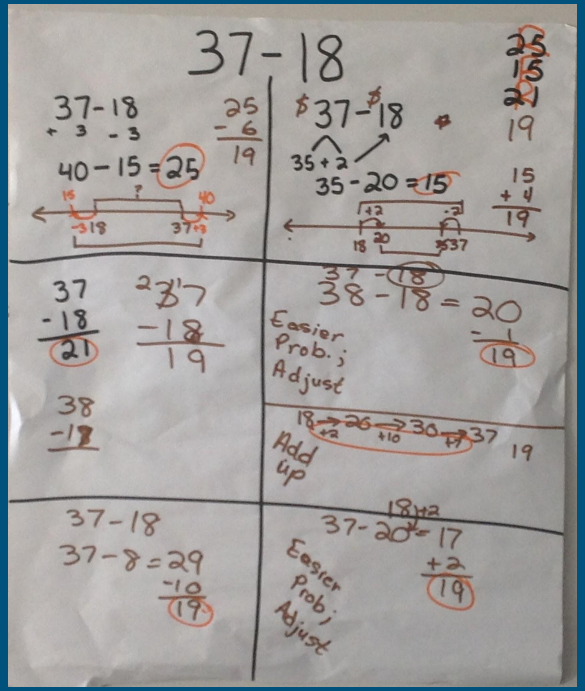
Number Talk Lesson Planning Template (adapted from Georgia Department of Education)

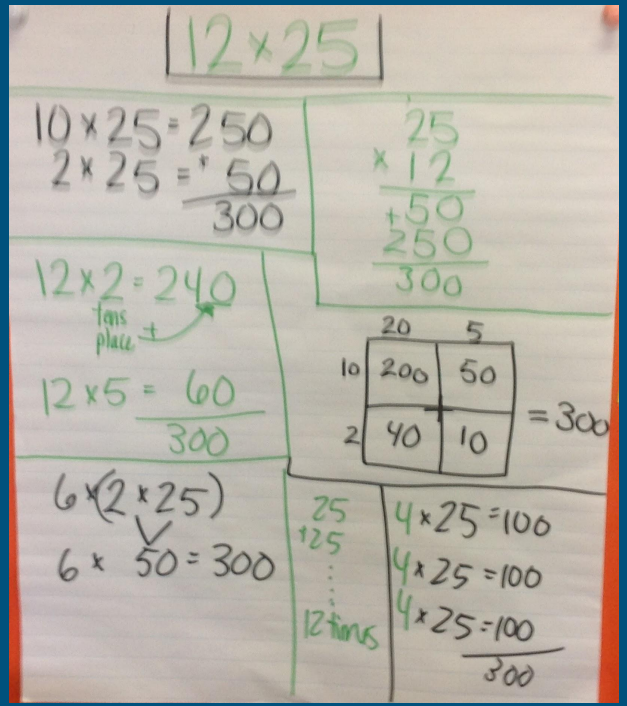
Grade Level: Fluency Target: Strategy focus:

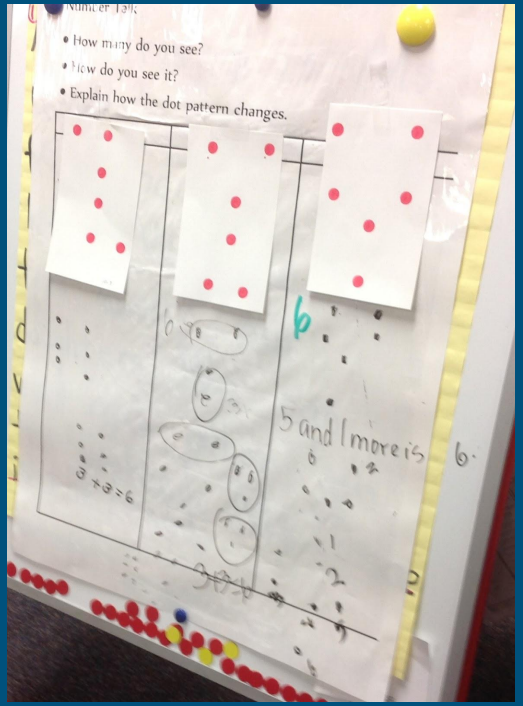
Number Talk Problem String(s)/Series	Possible Strategies and Method of Recording	Questions to Students

Academic Language	Next Steps	Extension

Samples of Completed Number Talks & Planning







First Talks - Easing into Expectations

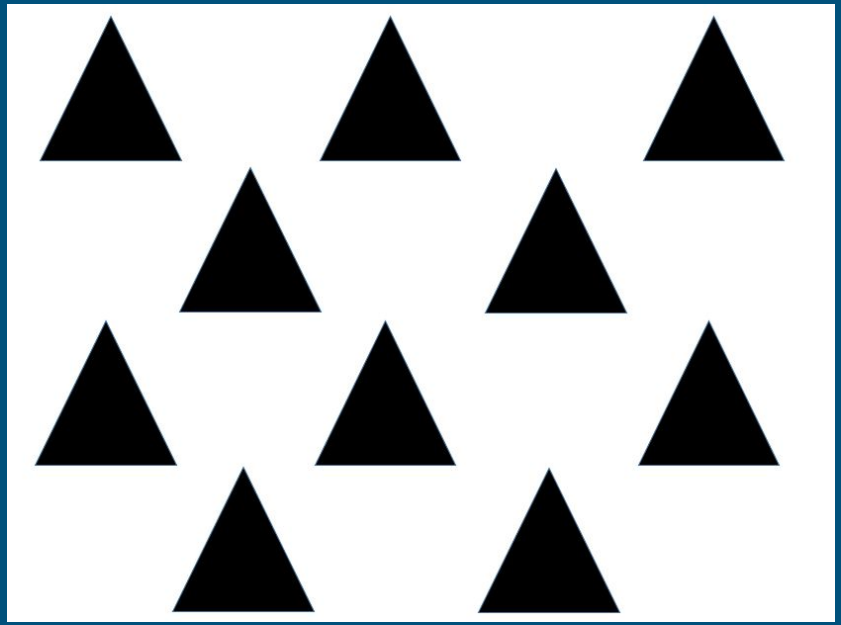
student thinking

explicit & precise explanations

vocabulary - concepts

expose relationships

comparisons



2. Formative Assessment - Number Talk Shock

Using properties and base ten understanding to compose and decompose

- Make tens and multiples of ten for addition and subtraction
- Using place value and partial products for multiplication and division

3. Representations

Hundred Charts

Number Lines

Arrays

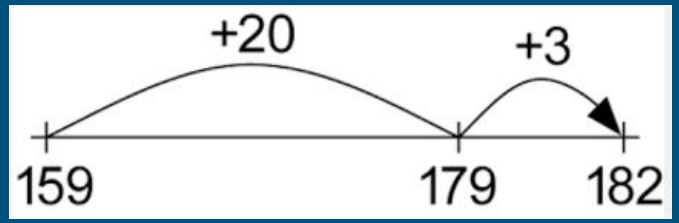
Area Models

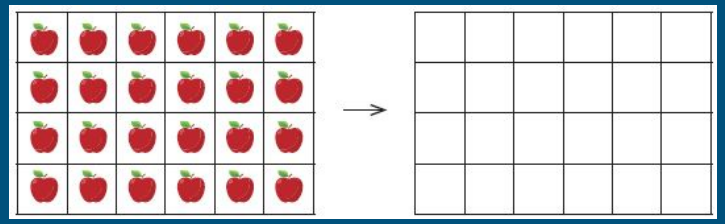
Symbolic

Diagrams

Hundreds Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



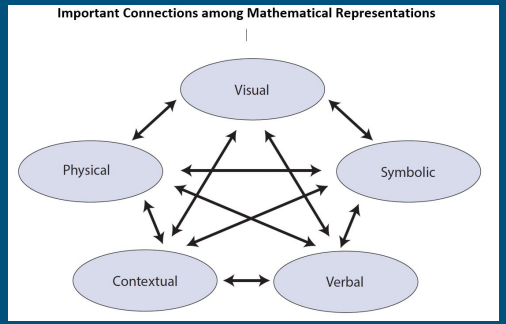


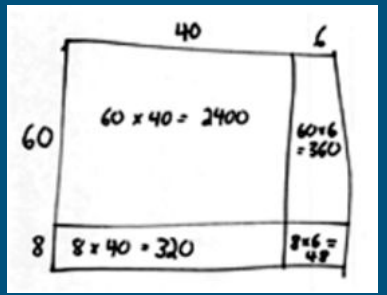
12 x 15 =

10 x 15 = 150

+ 2 x 15 = 30

180





(Principles to Action, NCTM, 2014)

Making 10s

3 + 2 + 7

"Three and two is five," 3 + 2 = 5

Then (counting on using fingers),

"6, 7, 8, 9, 10, 11, 12"

3 + 2 + 7

3 + 7 = 10

10 + 2 = 12

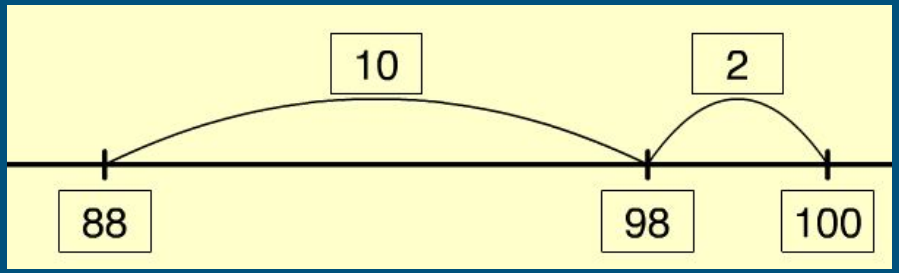
Efficient Strategies

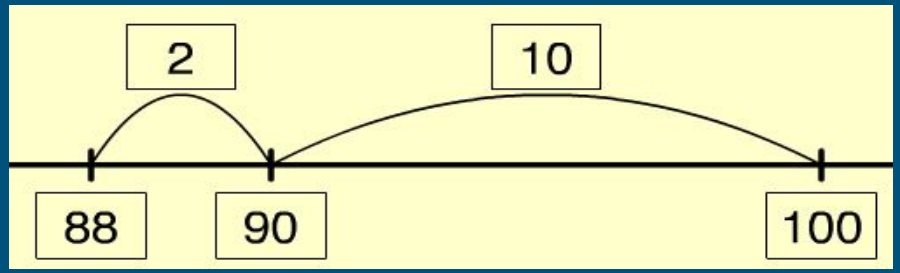
88 + 12 =

$$\begin{array}{r} {}^{1}88 \\ +12 \\ \hline 100 \end{array}$$

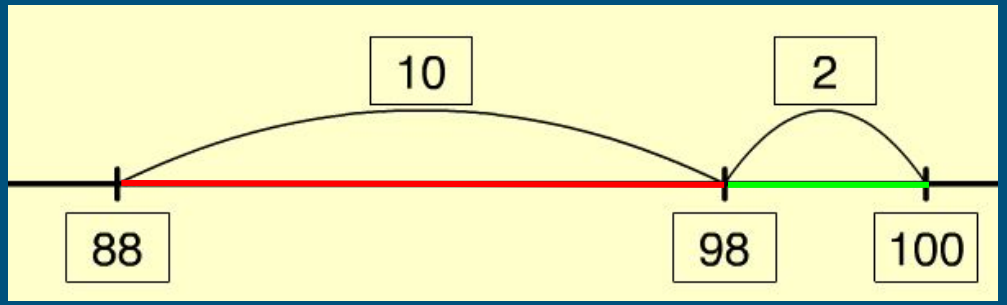
120 Chart

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120





Representations Supporting Base-Ten Thinking and Algorithms



81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110

88 + 12

80 + 10 = 90 9 tens

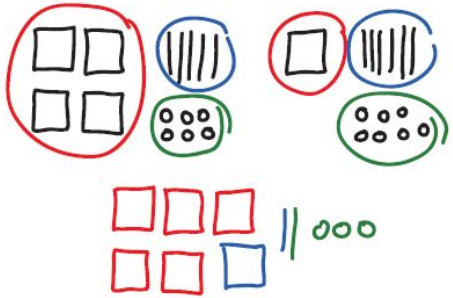
8 + 2 = 10 + 1 ten

100

2nd Grade

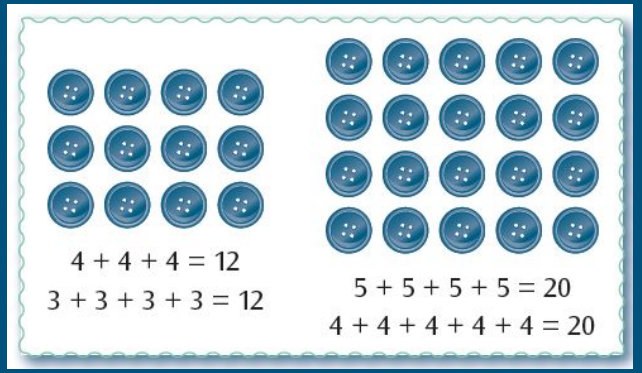
Examples 2.NBT.7

Addition Method 1: In this written addition method, all partial sums are recorded underneath the addition bar. Addition is performed from left to right in this example, but students can also work from right to left. In the accompanying drawing, it is clear that hundreds are added to hundreds, tens to tens, and ones to ones, which are eventually grouped into larger units where possible to represent the total, 623.

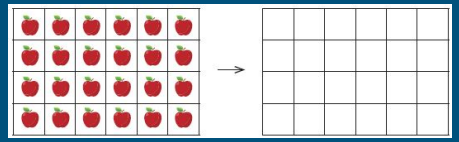


	4	5	6		4	5	6		4	5	6
+	1	6	7	+	1	6	7	+	1	6	7
					5	0	0		5	0	0
									1	1	0

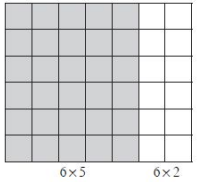
	4	5	6		4	5	6		4	5	6
+	1	6	7	+	1	6	7	+	1	6	7
	5	0	0		5	0	0		5	0	0
	1	1	0		1	1	0		1	1	0
							1			1	3
					6	2	3		6	2	3



3rd Grade



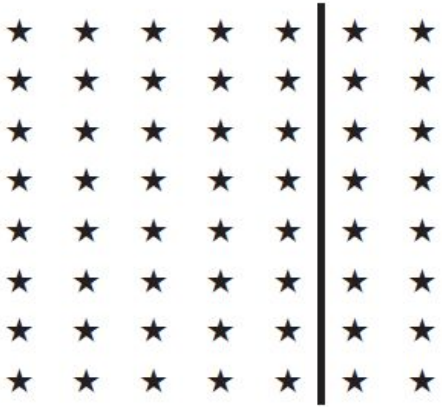
Students use area models to represent the distributive property in mathematical reasoning. For example, the area of a 6×7 figure can be determined by finding the area of a 6×5 figure and a 6×2 figure and adding the two sums.



7 x 8 = (5 + 2) x 8

8 x 7 = (4 + 4) x 7 =

I see that I can arrange the 7 columns into a group of 5 columns and a group of 2 columns.



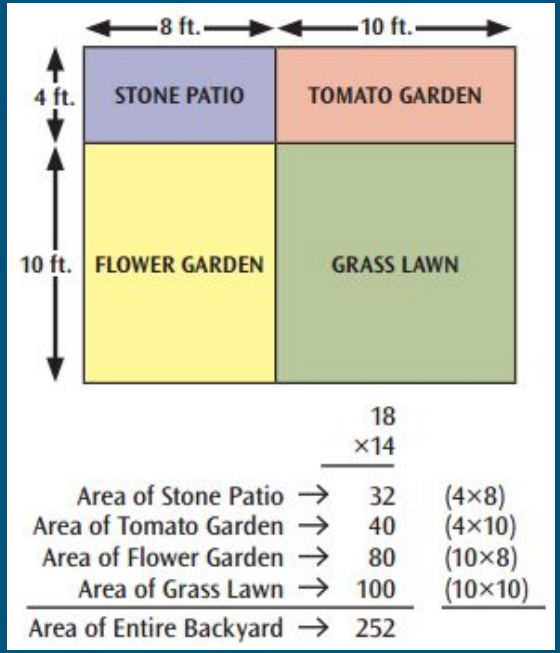
I know that the 5×8 array gives me 40 and the 2×8 array gives me 16. So altogether I have $5 \times 8 + 2 \times 8 = 40 + 16 = 56$ stars.

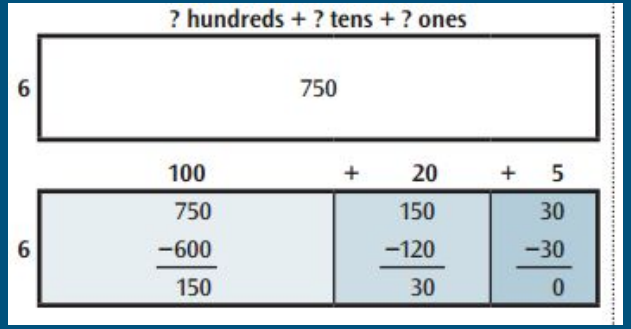
I see that I can arrange the 8 rows of stars into 2 groups of 4 rows.

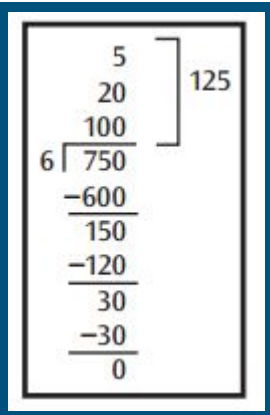
I know that each new 4×7 array gives me 28 stars, so altogether I have $4 \times 7 + 4 \times 7 = 28 + 28 = 56$ stars.

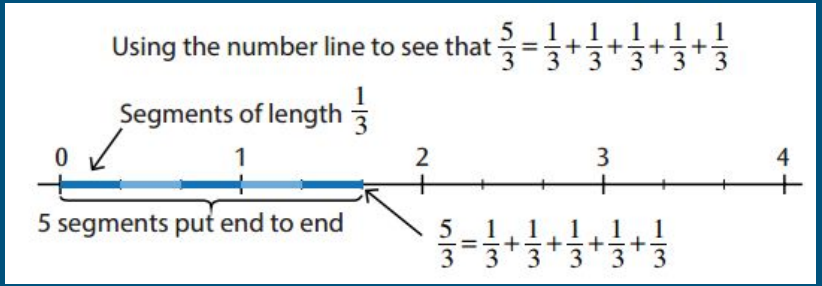
4th grade

Computation
Conceptual
Representation
Algorithm







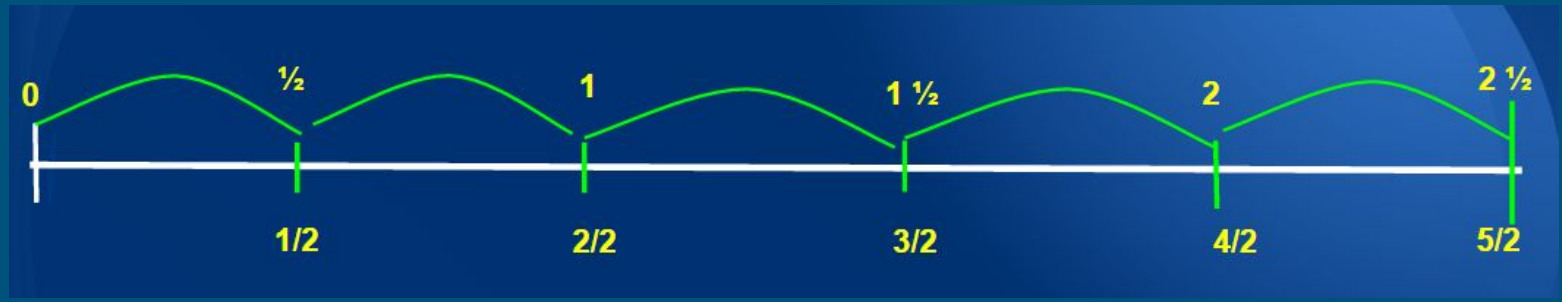


Fraction Multiplication (4th & 5th Grade)

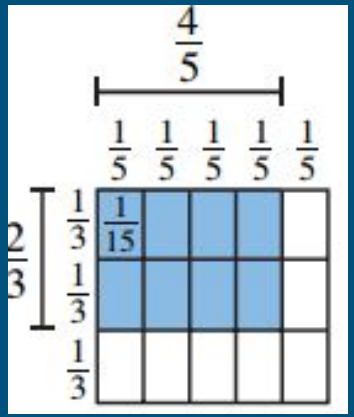
½ + ½ +½ + ½ + ½

5 x ½

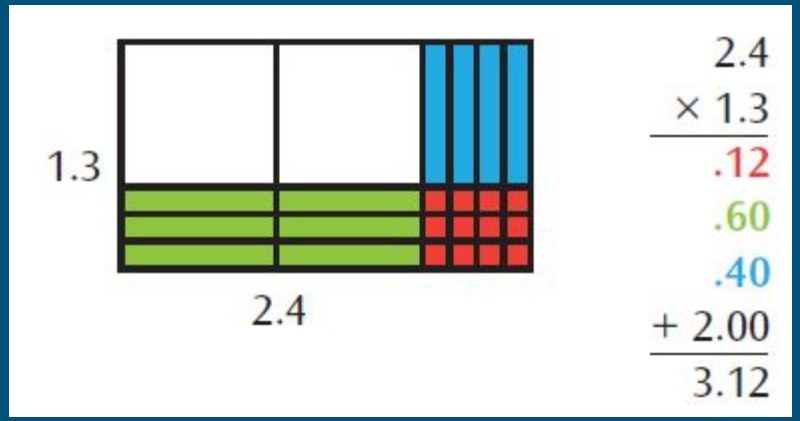
2 ½ ÷ 5

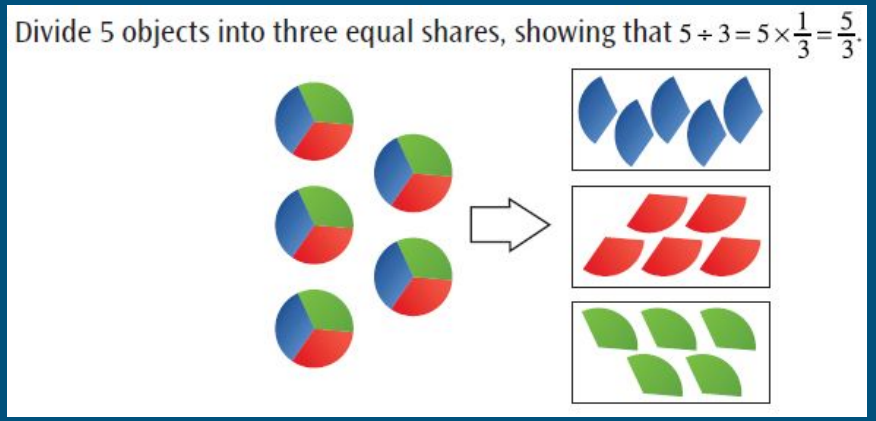


⅔ x ⅘



5th Multiplication and Division

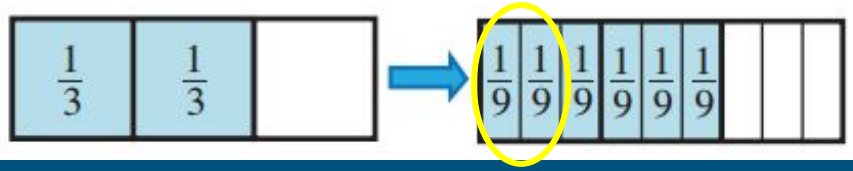




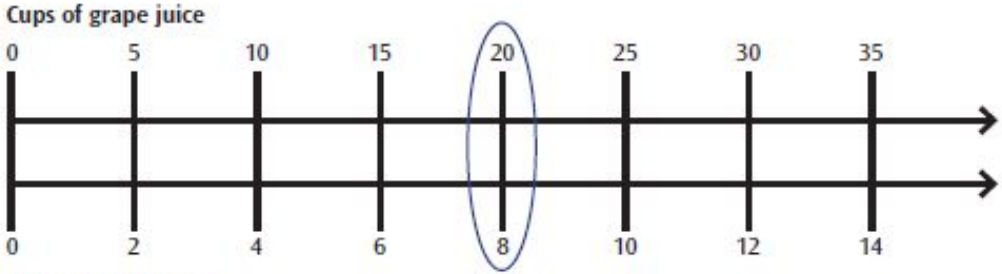
6th Grade

1. Three people share $\frac{2}{3}$ of a pound of watermelon. How much watermelon does each person get?

Solution: This problem can be represented by $\frac{2}{3} \div 3$. To solve it, students might represent the watermelon with a diagram such as the one below. There are two $\frac{1}{3}$-pound pieces represented in the picture. Students can see that $\frac{1}{3}$ divided among three people is $\frac{1}{9}$. Since there are 2 such pieces, each person receives $\frac{2}{9}$ of a pound of watermelon.



Using a Double Number Line Diagram: "I set up a double number line, with cups of grape juice on the top and cups of peach juice on the bottom. When I count up to 8 cups of peach juice, I see that this brings me to 20 cups of grape juice."



4. Connections to Other Math Instruction

- Fluency (including with algorithms)
- Explaining our thinking
- Investigations
- Direct Instruction

Fluencies

How numbers are composed and decomposed*

*Parrish, p.38

Grade	Required Fluency
K	Add/subtract within 5
1	Add/subtract within 10
2	Add/subtract within 20[1] Add/subtract within 100 (pencil and paper)
3	Multiply/divide within 100[2] Add/subtract within 1000
4	Add/subtract within 1,000,000
5	Multi-digit multiplication
6	Multi-digit division Multi-digit decimal operations

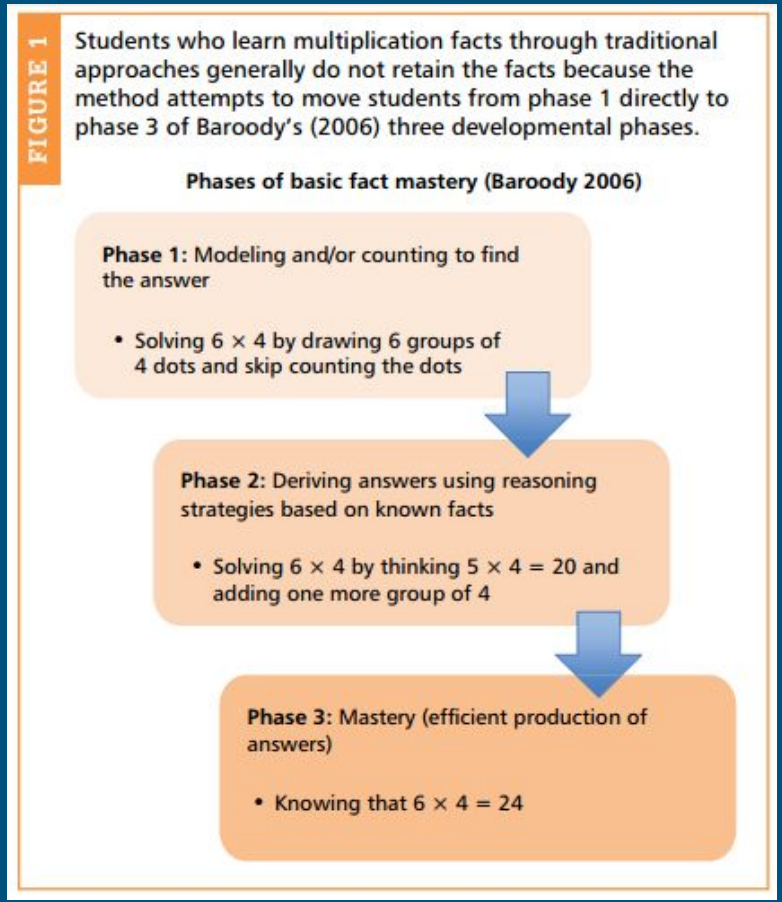
FLUENCY

California's Common Core State Standards for Mathematics (K–6) set expectations for fluency in computations using the standard algorithm (e.g., "*Fluently* add and subtract multi-digit whole numbers using the standard algorithm" [**4.NBT.4▲**]). Such standards are culminations of progressions of learning, often spanning several grades, involving conceptual understanding, thoughtful practice, and extra support where necessary. The word *fluent* is used in the standards to mean "reasonably fast and accurate" and possessing the ability to use certain facts and procedures with enough facility that using such knowledge does not slow down or derail the problem solver as he or she works on more complex problems. Procedural fluency requires skill in carrying out procedures flexibly, accurately, efficiently, and appropriately. Developing fluency in each grade may involve a mixture of knowing some answers, knowing some answers from patterns, and knowing some answers through the use of strategies.

3 Phases of Fluency

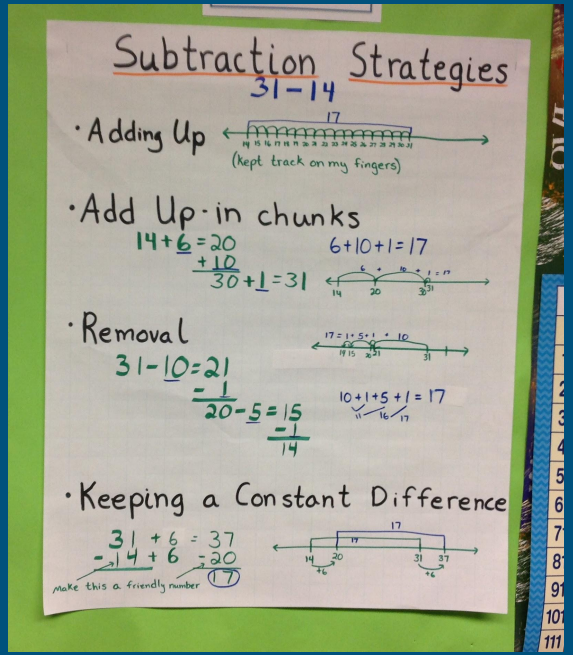
Phase 2

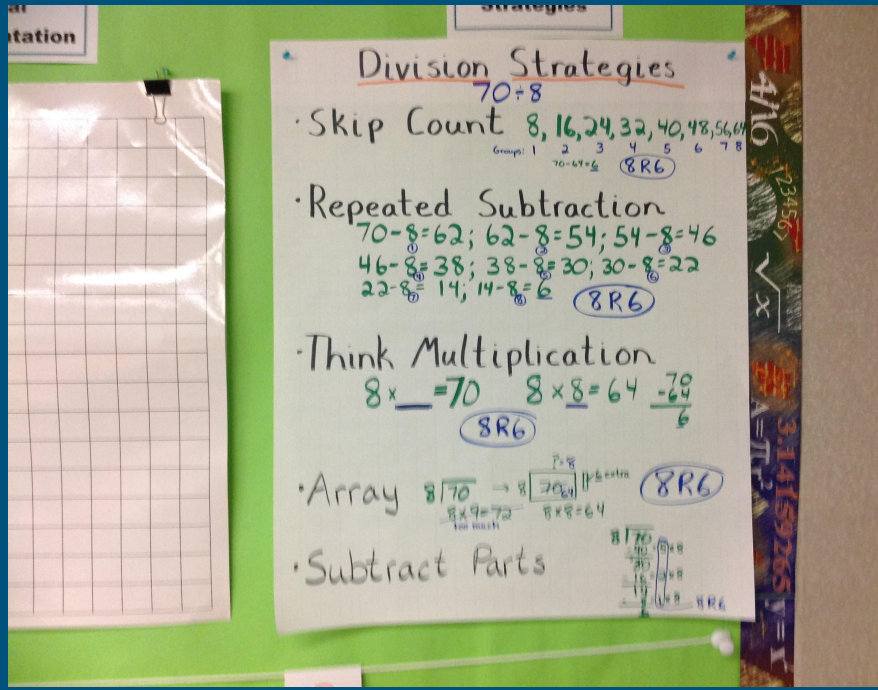
“Deriving answers using reason strategies based on known facts”



Kling & Bay-Williams, (2015), TCM

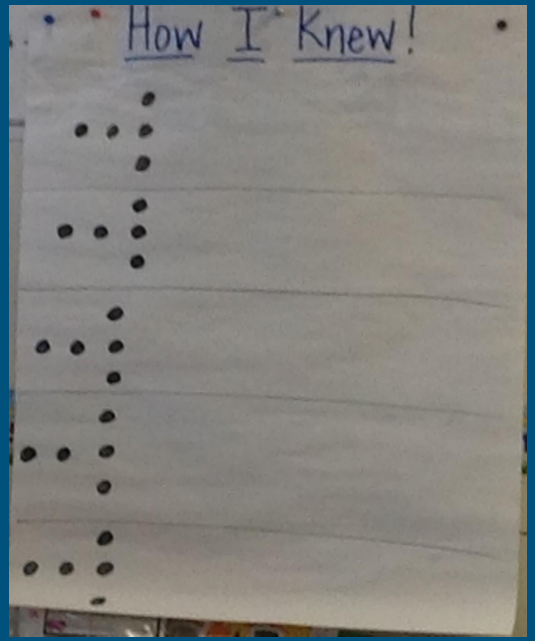
Strategy Charts

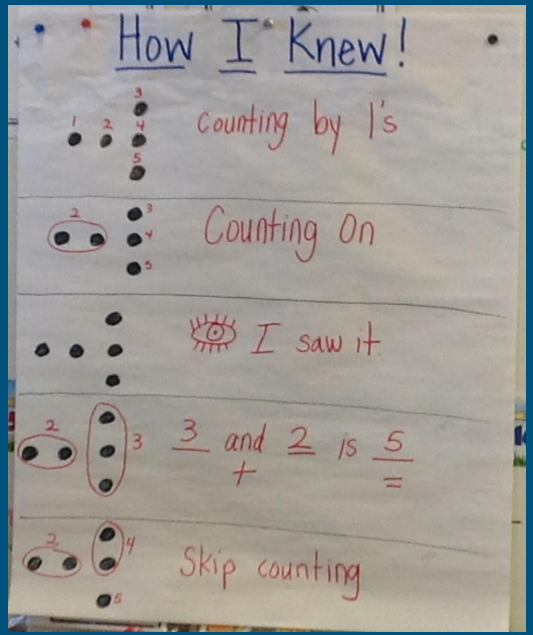




One Way to Create a Strategy Chart

Plan, Pencil, Coordinate, Side Notes as needed.





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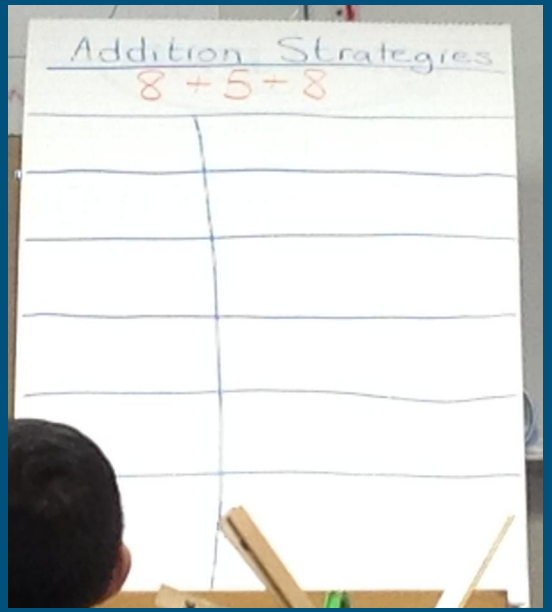

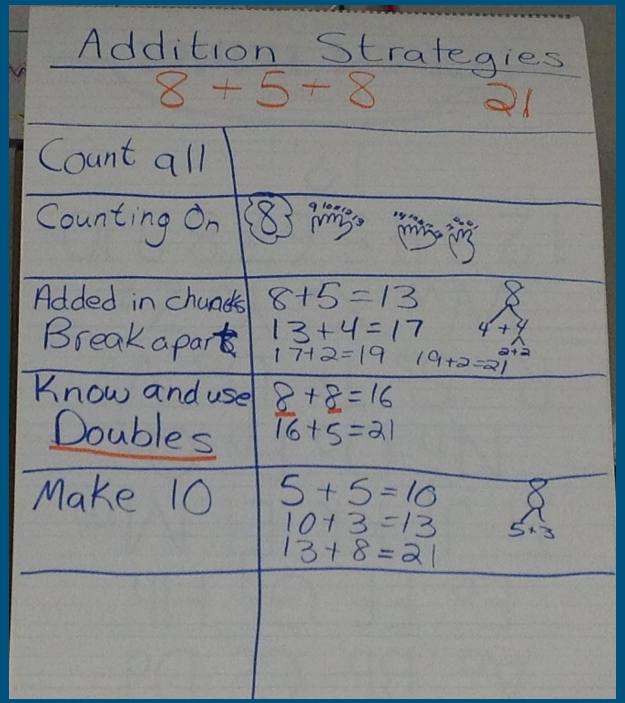

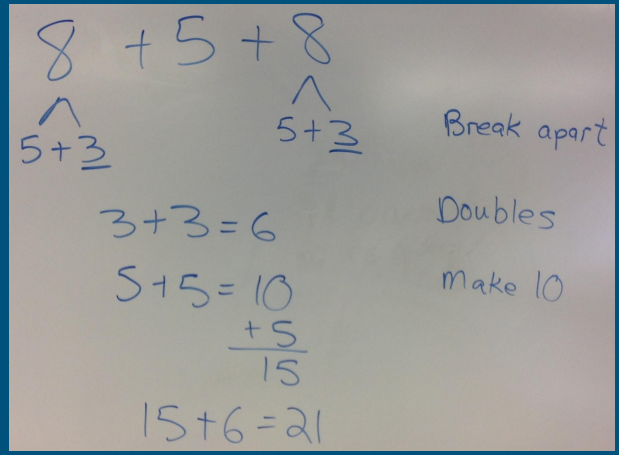

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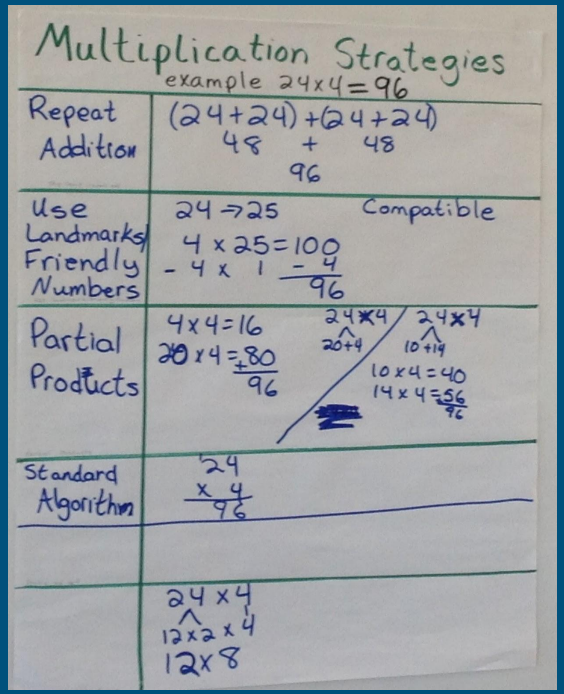
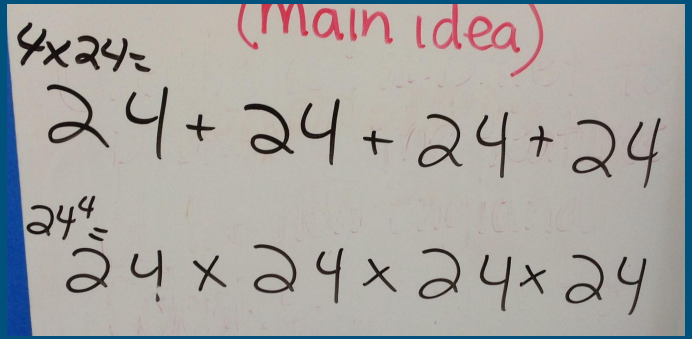




Practicing Strategies & Representations

- Frayer Model
- Investigations
  - “So and so did …”
  - Does the method work? Why or why not?
  - Does it ever work? Does it always work?
- Decisions:
  - Monitoring your Number Talk time
  - When and how to incorporate things that rise in Number Talks into instruction and vice versa

Summary: Number Talks Rock!

Apply a variety of strategies
Monitor and reflect on process
Justification as a fundamental aspect of math
Make and investigate conjectures
Select and use various types of reasoning and proof
Organize and consolidate thinking through communication
Communicate thinking clearly and accurately
Language of mathematics to express ideas precisely
Recognize connections among mathematical ideas
Create and use representations to organize, record, and communicate mathematical ideas

Mathematical Practices are Supported

Summary: Number Talks Rock!

Conceptual Understanding- Operations, relations

Procedural Fluency- Compute flexibly, accurately, efficiently appropriately

Strategic Competence- Represent and solve

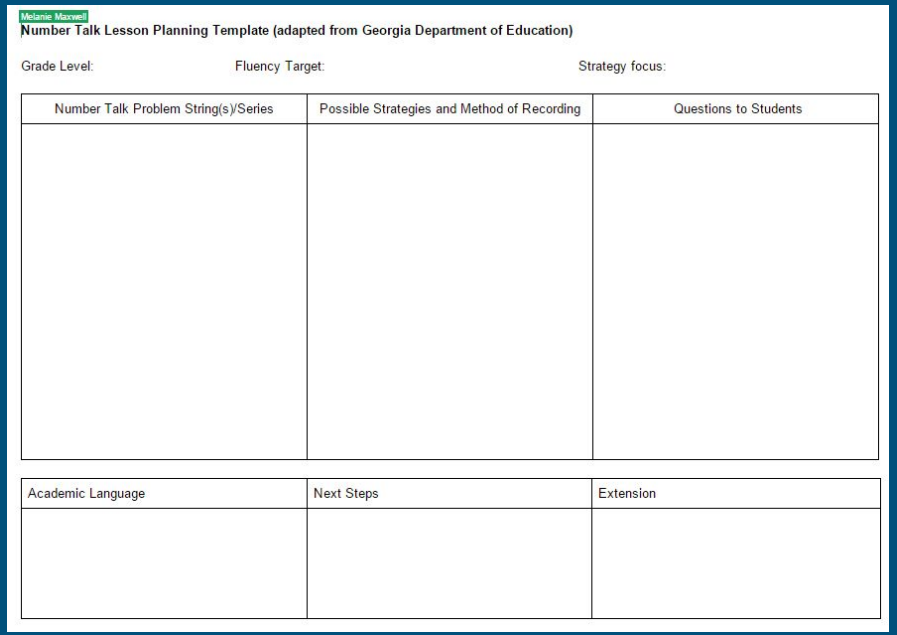
Adaptive Reasoning- Logical thought, reflection, explanation, justification

Productive Disposition- See math as sensible, worthwhile, and belief in one's own efficacy and as a *doer of mathematics*

Mathematical Proficiencies and Elements of Rigor are Supported

Today's Key Points about Number Talks	Implications for MY classroom
Formative assessment	
Students use multiple representations for conceptual understanding, solving, and justifying reasoning	
Supports a variety of opportunities for students to engage in the **Mathematical Practice Standards**	
Supports fluency in operations	

Planning and Next Steps



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Number Talk Lesson Planning Template (adapted from Georgia Department of Education)

Grade Level: Fluency Target: Strategy focus:

Number Talk Problem String(s)/Series	Possible Strategies and Method of Recording	Questions to Students

Academic Language	Next Steps	Extension

Self-Reflection

- What did the students know? How do they know it?
- Where could you have incorporated representations, possibly by asking, “May I show your strategy using a _____?”
- What vocabulary did you use? What vocabulary did the students use?
- Were student ideas expressed effectively and precisely?

CCSESA
California County Superintendents Educational Services Association
RIMS Region
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MaTHink 2016 Mini Conference

California Standards for Mathematics

Deepen your knowledge of California Standards, and learn how they will affect learning and teaching in the next few years. We will provide active sessions that will help make this information personal and applicable to your classroom. Topics include:

- Content Support
- Strategies for All Learners
- Assessment
- Discourse in the Mathematics Classroom
- Science, Technology, Engineering, and Mathematics (STEM)
- Community Outreach
- Math Coaching
- Mindsets